Convergence of the Eyes Mechanism:

Why Impairment in Certain Drug Categories may lead to ***Lack of Convergence.***

There is no simple mechanism to explain how we keep the images of eyes both eyes fused during convergence. However, there are essentially two systems that take the image in each eye and make them into one single image.

When we ask a person to converge their eyes, they have to take the image from each eye and keep them located on the target. This merging or **"fusion"** of slightly different images from the two eyes, arising from the difference of each one into one image is called **binocular fusion.** If they cannot, the person often will see **double or two images**. We have special detector systems in the back of our eyes that connect to the brain that tells us we are not "fusing" the two images. The brain then decides to readjust the eyes so they can "fuse" the images into one image and maintain **binocular fusion.**

What are these basic systems?

The first is ***fusional vergence***, which neurologically tells the eyes to keep the images "fused", and sends signals to the eye muscles to turn the eyes and converge while keeping them aimed at the target.

The second is called ***accommodative vergence.*** This is related to focusing or what is called "accommodation". When we focus to keep a target clear as we converge our eyes, this ***accommodative vergence*** also assists in turning the eyes inward and converge.

If we disturb or disrupt either one or both of these mechanisms, then the ability to readjust the eyes so they can "fuse" the images into one image while we are converging is not working properly any longer. This is called the **Lack of Convergence or Convergence Insufficiency**

It has been known for many years that ethanol and other CNS depressants can have an impairing effect on binocular fusion and the co-ordination of the eye's motor control and balance. When this binocular fusion mechanism is impaired during convergence, then the person cannot keep their eyes fused while converging as a target moves toward the nose.

With ethanol, when the legal blood-alcohol level is reached or exceeded, depth perception and night vision are affected. It becomes very difficult to accurately judge how far away objects are when depth perception deteriorates. Vision becomes **blurred** or the person may see **double** since the eye muscle control system and focusing system loses its accuracy causing the person to be unable to focus and converge both eyes on the same object.

Another example that is documented is lorazepam, a CNS Depressant (Ativan). There is **Lack of Convergence** due to impairment in the ability to converge the eyes, but did not affect accommodation.

In other drugs such as Inhalants and Dissociative Anesthetics, there is a CNS depressant effect taking place that is most likely disrupting the ***fusional vergence and/or accommodative vergence.*** This could easily result in the observed **Lack of Convergence.**

In Marijuana (Cannabis), the lack of convergence that may appear could have an underlying connection to a "focusing" or accommodative dysfunction and a breakdown in ***accommodative vergence.*** If the pupil is dilated, then there is a likelihood that focusing is also impaired which may then lead to reduced ***accommodative vergence and Lack of Convergence.*** There is another possibility that there also an effect on eye movement control that affects the ***fusional vergence*** as well contributing to the ***Lack of Convergence.***

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